DIAMOND-BEARING KIMBERLITE OF PRAIRIE CREEK, MURFREESBORO, ARKANSAS

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Until recently the Prairie Creek kimberlite was unique in that it was the only known occurrence of diamondiferous kimberlite in North America. It is also unique in being the only kimberlite in the U.S. that has been commercially exploited for diamond. However, in spite of these two features little modern petrological and mineralogical study has been undertaken and the most significant geological report on this locality is by Miser and Ross (1923). In this report we are concerned with the mineralogy and petrology of the pipe; subsequently we intend to examine the mineral inclusions from the authenticated diamonds from this pipe.

The total surface extent of the pipe is about 73 acres and within this area three distinct lithological types of rock can be identified: breccia, tuff and peridotite. In contrast to Miser and Ross (1923) it is believed the order of intrusion is breccia, peridotite and tuff. Based on geological evidence the pipe is believed to be early Late Cretaceous in age (Glenn, 1912). In close proximity to this large diatreme are 3 smaller satellite pipes. These have not been extensively investigated other than by Gregory (1969) who examined the geochemistry of soils overlying the pipes.

The breccia is believed to be the first intrusion and based on color and lithology can be subdivided into at least three events. In chronological order these are DH breccia, BGY breccia and "breccia dikes" (Lewis, 1977; Bolivar, 1977). Most of these breccias are very friable and consist of serpentine, chlorite and mica. In the DH breccia mica, perovskite and Mg-Cr spinels are present.

The tuff is blue-grey in color and contains altered breccias, mica, detrital quartz and other sedimentary fragments. Bedding is clearly evident and it is likely this material represents sub-aerial reworking of breccias that formed the original crater rim. Diamonds are usually found in the breccias, rarely in the tuff and appear to be absent from the peridotite.

The peridotite, micaceous in nature, is the freshest rock at Prairie Creek. In some respects it resembles the hardebank of South African kimberlites. Fresh olivine phenocrysts are common, plus smaller crystals of phlogopite. Minor diopside and chromite occur. Phlogopite often poikilitically encloses perovskite, chromite and small diopside crystals. Potassic richterite is also present and in this and other respects the rock appears comparable to a hypabyssal peridotite in Best's Mine, Barkly West (Erlank, 1973).

Mineralogically the tuffs and breccias are of limited nature although as noted above these two rock types are diamondiferous. Garnets have been reported in the peridotite but during the present study have only been obtained from the breccia and tuff. Two distinct garnet suites are noted. One group is kimberlitic in character (Table 1) whereas the other is most likely crustal in origin. These latter garnets contain numerous inclusions of apatite, ilmenite and magnetite.

The peridotite appears to contain two distinct groups of diopside (Table 4) but texturally there is no evidence to indicate the chemical disparity. During the present study no mantle xenoliths have been found in the peridotite, breccia or tuff.

Although diamonds were not studied as part of this initial investigation it is worth noting that approximately 40 cts per year are found by tourists mining the pipe at leisure. Unfortunately, the original mining records are sufficiently vague that it is not possible to properly assess the total production and quality. However, in the years following the 1939-45 period one stone of 40 cts (Star of Arkansas) was found and more recently a 16 ct stone was discovered.

References

Bolivar (1977) Ph.D. Thesis. Univ. of New Mexico.

Erlank (1973) (Abs.) Int. Kimb. Conf., Cape Town.

Glenn (1912)(Abs.) Geol. Soc. Amer. Bull., 23, 726.

Gregory (1969) Ph.D. Thesis. Imperial Coll. London.

Lewis (1977) M.S. Thesis. Purdue University.

Miser and Ross (1923) U.S. Geol. Surv. Bull, 735, 279-322.

Table 1. Representative Analyses of Minerals (except garnet) from Hypabyssal peridotite.

	Garnet	Diopside	Diopside	Olivine	Phlogopite	Richterite	Spinel	Perovskite
SiO_2	42.5	54.2	54.8	41.5	42.5	55.3	-	-
TiO_2	0.09	0.47	0.13	0.01	3.30	2.44	2.40	53.7
Al_2O_3	22.5	0.02	1.88	<0.01	4.96	0.29	0.48	0.04
Cr_2O_3	1.80	0.16	2.34	0.15	0.10	<0.01	0.91	0.65
FeO	7.51	2.52	2.56	8.14	7.70	3.88	82.5	0.72
MgO	20.5	17.6	17.8	50.3	22.9	20.8	2.85	0.30
CaO	5.09	24.6	18.7	0.04	2.60	6.01	0.20	38.9
MnO	-	0.11	0.15	0.16	0.07	0.09	0.46	0.02
NiO	<0.01	-	-	0.38	0.10	0.02	<0.01	<0.01
Na_2O	<0.01	0.38	1.51	<0.01	1.16	4.47	-	0.57
K_2O	-	0.02	0.09	<0.01	9.51	5.14	-	-
Nb_2O	-	-	-	-	-	-	-	0.38
	100.1	100.1	100.0	100.7	(95.0)	(98.4)	(89.8)	(95.3)